THE

PSYCHOLOGICAL BULLETIN

THE LEARNING PROCESS.[1]

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The special feature of this investigation of the learning process consists in an accompanying curve of errors, traced from the number of mistakes made by the subject during each day's practice. The method followed in the practice tests differed from that of the writer's earlier investigation of typewriting, when lettered keys and the sight method were used. In the present instance the touch method was followed, the writer keeping his eyes on the copy. The exercises contained in Grant's typewriting manual were used until they were exhausted, and after this, lectures and essays were copied. The manner of measuring the rate of progress was also changed. In the former investigation the word was the unit of measure, and the number of words written during the period of the test gave the day's record, but this time it was the number of strokes made which determined the daily score. This, of course, included punctuation and spacing, as well as each letter written, and was, therefore, a more accurate unit of progress than the word.

The machine used in the test was the latest Underwood, with the universal key-board. Two years before, Mr. Schuyler had used an old fashioned caligraph, but the key-board of this was so different from the modern machine that the skill acquired at that time was of no assistance in mastering the Underwood. Except for this practice

[1] The tests which form the basis of this paper were made, at the suggestion of the writer, by Mr. William Schuyler. The pressure of other interests, however, caused him to turn over his material to the undersigned with the request that he prepare it for publication. — E. J. S.

on the caligraph, which ended two years previously, Mr. Schuyler
had never used any typewriter.

The investigation was continued through sixty-six consecutive
days, with the omission of Sundays, the first half hour in the morning,
from eight to half past, being set aside for the work.   The practice
tests of the experiment closed December twenty-sixth, and on the
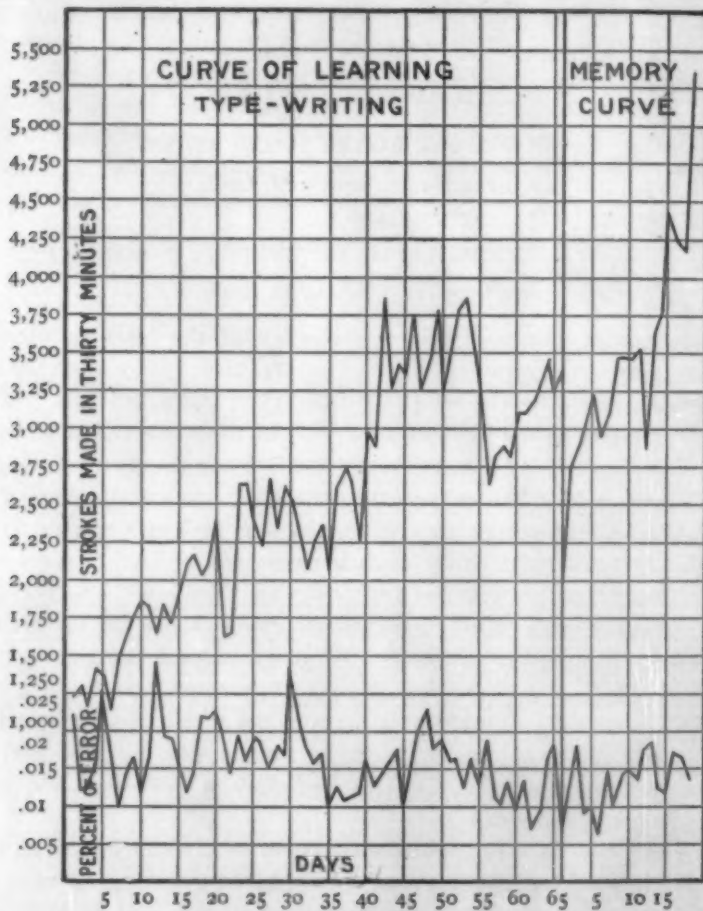twentieth of the following March a memory test was begun, the curve

FIG. 1.

of which will be found at the right of the vertical line drawn immedi-
ately after the sixty-sixth day, the close of the regular practice tests.
During the interval Mr. Schuyler had not used the typewriter, ex-
cept to copy one letter.

The curves are given in the figure, the upper one representing the

daily progress in the work, and the lower giving the percentage of daily errors. The figures to the left of the curve of learning show the daily progress, while those to the left of the curve of errors give the daily percentage of errors. The days during which the tests were made are shown by the figures below the horizontal line. The curve of the memory test, which was begun eighty-four days after the conclusion of the practice tests, and continued eighteen days, stands at the right of the practice curve, with the corresponding curve of error below, as before. The reason for continuing the memory test through eighteen days was to determine the new rate of progress.

The upper curve is seen to take the irregular form which the writer's earlier investigations have shown to be characteristic of the learning process.

Up to the twelfth day Mr. Schuyler used only two rows of keys, but at this time the third row was introduced into the work, though at first only for practice on the location of letters. The use of the third row for sentences was begun on the fourteenth day. On each of these days, as the curve shows, the score dropped noticeably, but it will also be seen that recovery of former speed was rapid.

The marked drop of the twenty-first day was due to the delay caused by learning to use the shift key for capitals and punctuation. It is interesting to observe here that the percentage of errors was much reduced on this day, and that those which were made did not occur in the capitals.

No reason can be assigned for the low record of the thirty-first and thirty-second days. Mr. Schuyler's notes say that he slept well the previous night and that he felt in unusually good condition. The recurrence of the low score on the thirty-fifth day, however, may be accounted for by the fact that at this time the writing of connected matter took the place of simpler, disconnected sentences. The low percentage of errors on this day is worthy of special observation, since, with the exception of the seventh day when the subject was using two rows of keys, they are fewer than at any previous time.

On the thirty-seventh day Mr. Schuyler finished the exercises in the manual, and the next day he began to copy one of his own lectures, written some months before. This sort of work was continued through the forty-second day when the exercise was changed to repeating the same sentence throughout the entire half hour. This repetition-exercise, which was continued through the fifty-fifth day, puts this period of time into a group by itself. The most interesting fact regarding it is, perhaps, the plateau. It is rather remarkable that these two weeks, each day of which was spent in practice on a single, short sentence,

brought no increase of speed. On the fifty-sixth day, at the writer's suggestion, Mr. Schuyler again took up the copying of connected thought which he continued until the close of the investigation. As the curve shows, five days were required to regain the speed which he had acquired at the time of beginning the repetition-exercise.

Mr. Schuyler agrees with the writer that there is no separation of the higher from the lower habits. Early in his work some of the short, common words became automatic, but to the end, other longer and less frequent ones were written by letter.

The memory test was started eighty-four days after the close of the regular practice work. As is seen from the curve, eight days were needed to enable Mr. Schuyler to equal the speed with which the practice tests closed. After this his progress was strikingly rapid, the curve shooting upward with much the same form as the writer found in his earlier investigation[1] of memory.

In the curve of errors that which attracts attention is the remarkable persistence and regularity of the mistakes. The tracing shows that the mass of errors lie between one and two per cent., with an average error of a little over one and one half per cent. These errors, again, gradually diminish, during the entire period, at the approximate rate of eight thousandths of one per cent. per day.

In the memory tests the average per cent. of errors was found to be one and thirty-four hundredths, slightly less than that of the regular practice tests.

Examination of the written exercises showed that the errors always came in bunches, and, when in threes, one group was near the beginning, another about the middle, and the third toward the end. Sometimes there were only two groups, but after the mistakes were marked with red ink, the alternation of spotted spaces with those free from marks was striking.

With Mr. Schuyler, at least, there was no connection between the number of errors and the repetition of copy. He made rather more than the average from the forty-second to the fifty-fifth day, when he was repeating one sentence each day. It is also interesting to observe that increased speed was usually associated with a greater number of errors, though the proportional increase was not the same. On the twenty-third day, for example, when the count showed sixty per cent. more strokes than on the previous day, the increase in errors was forty per cent.

The relation of errors to progress in a new line of work calls for further investigation. Such a study might show what methods economize time and energy, by disclosing the conditions favorable to errors.

[1] PSYCHOLOGICAL BULLETIN, 1906, III., 186.

PSYCHOLOGICAL LITERATURE.

HARVARD STUDIES.

Harvard Psychological Studies. Volume II. Edited by HUGO
 MÜNSTERBERG. Boston and New York, Houghton Mifflin & Co.,
 1906. Pp. 644.

This volume contains twenty-three experimental articles by various
authors, and five essays and speeches under the general heading
' Emerson Hall' by Professor Münsterberg. The experimental arti-
cles are grouped in the volume under the headings given in order
below.

OPTICAL STUDIES.

Stereoscopic Vision and the Difference of Retinal Images: G. V.
 HAMILTON.
Eye Movement During Dizziness: E. B. HOLT.
Vision During Dizziness: E. B. HOLT.
Visual Irradiation: FOSTER PARTRIDGE BOSWELL.

Hamilton's experiment was on the binocular judgment of the dif-
ference in distance of two lines, one of which was at a standard
distance of two meters from the point midway between the subject's
corneæ. The lines were sections of the edges of two opaque screens,
seen through a rectangular opening in a fixed screen a little distance
in advance of the two. Observations were made: (1) With the eyes
in normal position, *i. e.*, with the line of binocular regard perpendicu-
lar to the line joining the two corneæ, (2) with the corneal line turned
15° from this position, and (3) with a similar rotation of 30°. In
each of these positions Hamilton obtained thresholds for movement of
each edge toward and away from the eyes, and from the thresholds he
concludes that binocular disparity alone is insufficient ground for
stereoscopic effect, but that sensations of eye positions are required
also.

This conclusion rests on two contentions: (1) That so far as the
disparity of the images is concerned, turning the head to the left and
consequently bringing the right eye nearer the edges relatively to the
left eye, is equivalent to moving the right edge farther away with eyes
in normal position; and (2) that nevertheless, the thresholds and
apparent equality points are practically the same in the different posi-
tions although even the 15° shift of the head introduces binocular dis-

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parity of images much greater than that due to moving one of the lines past the threshold with eyes in normal position. The disparity due to turning the head produces therefore no stereoscopic effect.

There are three defects in Hamilton's methods which make his results inconclusive. (1) With his apparatus the turning of the head was not really equivalent to moving one of the lines. This was because of the fixed rectangular opening mentioned above. Under that condition, moving a line backwards or forwards did rot change its angular length, while turning the head shortened the lines relatively for the far eye in the same proportion as it decreased their angular separation. This feature of the disparity induced by turning the head is therefore just as prominent as the other and could easily offset it. (2) No account is taken of accommodation, which is certainly a factor at the distance of two meters. (3) In working up his results, Hamilton considers a difference of position in which the right line is moved back (a plus movement in his code), to be opposite in effect to a difference in which the left line is moved forward (minus movement), and so he averages the two algebraically in getting his equality point. In reality the differences of position are in the same direction, and if averaged at all should be averaged arithmetically; the result being not an average equality point but an average deviation of the two equality points from zero. Thus, in the case of Subject Tait, with the head turned 15° the two edges seemed at equal distances when the right edge was 5.91 mm. farther away, or the left edge 1.49 mm. nearer (the other edge in each case fixed at 2 meters), and hence Hamilton makes the 'middle point' at + 2.21, which is of course an absurdity.

Aside from the unfortunate fixed screen Hamilton's apparatus seems to have been excellent, and adapted to secure great accuracy.

Holt's first paper is a report on photographing of eye movements during dizziness occasioned by rotating the subject about the vertical axis, twenty-five rotations in fifty seconds. By a very clever device the eyes were fixed in a position in two or three seconds after stopping the rotation, and the photographic exposure, with film moving vertically, began then and continued nine seconds. Holt tried first photographing the whole eye, and then a flake of zinc white on the cornea, but got no good results. Finally he used the corneal reflection of an A.C. arc light, and obtained some splendid photographs, showing clearly the slow movements in the direction of the previous rotation and the rapid recovery movements in the opposite direction. The duration of the slow movements is about six times that of the fast ones, but increases from the first to the ninth second, while the duration of the fast movements remains practically constant.

Holt's second paper describes observations on vision during the slow and fast eye movements of dizziness. The first experiment, on Holt himself, was on the vertical movements of an incandescent lamp at a distance of four meters, after rotation as above described. The uniform result was the perception of oblique motion, always in the direction due to the combined vertical movement of the lamp and the horizontal *slow* eye movements. Although in this case the lessened retinal effect of the lamp during rapid movements *might* account for its invisibility during such movements, the central location of the inhibition is indicated by corresponding observations during the photographic experiments. In these the subjects noticed that during rotation the arc lamp swam always with the rest of the visual field in the direction opposite the slow eye movements, although the arc lamp is an adequate retinal stimulus even during the fastest eye movements.

The second experiment was on the movements of after-images under the rotation conditions. The subjects, of whom there were four, obtained a lasting after-image before rotation, and found that during rotation the after-image moved in the direction opposite that of rotation, and after rotation moved in the direction of the rotation, *i. e.*, in both cases in the direction of the slow eye movements. Rotation about transverse axis of head (bending head over on one side), gave corresponding results. The image may be easily seen to repeatedly disappear at one side of the visual field and reappear at the other.

The final observation, confirmed on several subjects, was that while the rapid eye movements can be voluntarily inhibited, the slower ones cannot.

The most remarkable of the results of these experiments is that in all of them the visual field moved in the direction of the rotation during rotation, and in the opposite direction after rotation. The ordinary experience (as described by Delage in the passage quoted by Holt), is that during rotation the apparent movement of the field is in the direction opposite to that of the rotation and after rotation ceases the field apparently moves in the direction in which the rotation was. Yet Holt found unmistakably in every experiment that when the rotation was 'clockwise' the after movement, was 'anti-clockwise' (p. 71), and that in general the apparent direction of movement of the visual field was 'opposite to that of the slow eye movements' (pp. 68, 69), and these slow movements, as is well known and as Holt's photographs show, are during rotation in the direction contrary to rotation, and in the rotation-direction after rotation. If in some subjects, as in Holt's, the apparent movements are in one direction,

although in the ordinary subject they are in the other direction under the same conditions, while the eye movements are presumably the same in all cases, a new line of interpretation is opened up.

Boswell's experiments were on the apparent changes of shape which certain spots of light undergo when moved rapidly across the retina with the eyes fixed. By means of a pendulum device spots of various forms and not exceeding $1°$ $10'$ of visual angle were moved at various rates over an area including practically only the fovea. Under these conditions the upper and lower portions of the figure appear displaced backwards, so that, for instance, a vertical bar appears as a crescent. Boswell believes that this is due to irradiation, which strengthens the central region of the lighted area, causing it to come to consciousness before the peripheral regions, and hence spatially in advance of them. To establish this explanation, Boswell tried darkening the middle regions of certain spots, and was able by proper darkening to prevent the backward displacement of the upper and lower portions, or to produce a forward displacement, although the amount of darkening necessary is hardly perceptible with the figure at rest. Spots of light longer vertically than the ones mentioned above gave a straight middle region with curved ends, since the irradiation along the middle region was nearly uniform.

By an ingenious arrangement of cross wires, Boswell measured the apparent curvature of a vertical band at different speeds and with different intensities and colors of light. He found that with increasing intensities the displacement at first increased and then decreased. Green gave the greatest maximum of displacement, red and blue the least, yellow being about midway between.

In the speculative part of the paper Boswell expresses the belief that the irradiation takes place in retinal layers more inward than the rods and cones, approves W. McDougall's neurological theory as a provisional scheme, and conjectures a central origin for color blindness.

FEELING.

The Expression of Feelings: F. M. URBAN.
The Mutual Influence of Feelings: JOHN A. H. KEITH.
The Combination of Feelings: C. H. JOHNSTON.
The Esthetics of Repeated Space Forms: ELEANOR HARRIS ROWLAND.
The Feeling-Value of Unmusical Tone-intervals: L. E. EMERSON.

Urban states at the beginning of his paper that the material for it was obtained by an experimental investigation carried on in the Har-

vard laboratory, but he gives no information as to the nature of the experiment. The paper is in substance a discussion of the nature and possible causes of the dicrotic elevation of the arterial pulse, with an excellent account of the several theories and of the study of the pulse from Marey's experiments to the present day. Urban decides that the cause of the dicrotic elevation is that which Landois assigned to the pre-dicrotic and post-dicrotic elevations, namely, arterial elasticity. .

Keith presents with the least possible comment the results of a long series of experiments with two subjects on the hedonic ranking of various colors, tone combinations, and surfaces actively or passively touched. Twenty-seven tone combinations and fourteen of each of the other groups were separately given their values in the conventional scale of seven degrees of pleasantness-unpleasantness, and then the members of each group were combined in turn with members of the other groups and assigned values under those conditions. The general averages indicate that combining colors and tones lowers the agreeableness of both, while combining colors and passive touch or tones and active touch raises the agreeableness of both in both cases. For the other combinations the results are not concordant. No details of the effects of individual members of one group on the various members of the others are given.

Johnston's article is in many respects the complement to Keith's. The experimental results presented are merely a mass of introspection from twelve subjects, either on viewing Perry Pictures, or experiencing combinations of odors, tones, noises, touches, and space forms, a member from each of two of these groups being used in each combination. The deliverances of the subjects in attempting to tell the way things felt to them are an interesting study in elevated metaphor. Apparently neither subjects nor author spared words. The main problem seems to have been to find if two feeling tones could be present at once and if the general conditions of complex feeling tones agree with the Münsterburg Action-Theory, on both of which questions the author concludes affirmatively.

The first part of Miss Rowland's paper reports the introspection of seven subjects on viewing regularly repeated groupings of lines. The lines were white strings hung across a black background, shifted through a great variety of groupings. Miss Rowland thinks the introspection shows that the properties of repeated space-forms are analogous to those of auditory rhythm as the latter are set forth by Mac-Dougall. The second part of the paper is devoted to a study of approved architecture, attempting to show that it embodies the same

principles as are brought out in the first part.   Whether in either part
the author makes out her case is not to be answered offhand.   The
material is presented with little regard for clearness, conciseness or
unity, so that the reader can hardly escape getting lost in the diffuse
miscellany of details.

Mr. Emerson experimented with what he designates by the unfor-
tunate term 'amusical' melodies; *i. e.*, series of three notes on two
pitches including an interval varying from 460 : 456 to 460 : 516, and
from 384 : 436 to 384 : 516, by steps of four.   The subjects estimated
the values of the 'melodies' in the seven-degree hedonic scale, and
afterwards estimated independently the harmony of the two pitches.
Later, some experiments were made with from three to six notes on
three pitches differing by 4, 8 and 12 vibrations, absolute pitch not
stated.   The results show that the intervals used do give decided feel-
ing tones in most cases; that the preferences for melody do not corre-
spond to those for harmony; and that the preferred melodic intervals
within the range indicated are (according to Emerson), from four to
eight vibrations less than the 'half or full tone of the musical scale,'
and likewise fail to correspond with the musical intervals from the
second to the fourth.

Emerson *apparently* takes account of *major* tones and semitones
only, in computing musical intervals, and hence does not notice that
the preferences are approximately for the minor tone and semitone.
The paper is gotten up carelessly, to say the least, and the reader is
left in doubt about many points.   In plates showing melody-curves
one may identify them with some trouble after he has decided whether
the intervals marked are diatonic, chromatic, or tempered; but the
significance of two sets of harmony-curves in one plate is entirely
obscure, as is the reference to 'Tables I. and II.,' no tables being
discernible.

ASSOCIATION, APPERCEPTION, ATTENTION.

Certainty and Attention: FRANCES H. ROUSMANIERE.
Inhibition and Reinforcement: LOUIS A. TURLEY.
The Interference of Optical Stimuli: (MISS) H. KLEINKNECHT.
Subjective and Objective Simultaneity: THOMAS H. HAINES.
The Estimation of Number: C. T. BURNETT.
*Time-Estimation in its Relation to Sex, Age, and Physiological
       Rhythms:* R. M. YERKES and F. M. URBAN.
Association under the Influence of Different Ideas: BIRD T.
    BALDWIN.
Dissociation: C. H. TOLL.

From the introspective records of eight subjects on their judgments of visual and tactual recognition, Miss Rousmaniere concludes that certainty has different characteristics in different individuals, and varies in degree in each one; but that the judgments pertaining to one sense have no different kind of certainty from those pertaining to another sense. Individual differences may constitute different types of certainty; but this is a surmise rather than a conclusion. Miss Rousmaniere also made experiments with attention to one factor of a complex visual object, to note the certainty of judgment to non-attended factors. Figures or letters, and geometric forms of various colors were simultaneously exposed on a card for two seconds, and the subject immediately afterwards enumerated what he had seen, grading his judgment regarding each factor (characters and form, color, and number of objects) in four arbitrary degrees of certainty. Results showed that although attention to one factor increased the percentage of judgments of highest degree of certainty with respect to that factor, there were also judgments of this degree with respect to the unattended factors. In spite of a few flaws, Miss Rousmaniere's paper is a model of clearness and conciseness.

Turley and Miss Kleinknecht experimented along the lines of Ranschburg's work on the effect of duplicates on memory. They exposed series of six arabic letters in succession and required the subject to write the series immediately afterwards. In Miss Kleinknecht's experiment each series contained one pair of duplicates in various positions, and the inhibition of the second of the pair was found to be greatest when they were adjacent, and when they occurred in the last half of the series. The method by which Miss Kleinknecht's results were computed is obscure, and in general she presumes entirely too much on the ingenuity of the reader.

In Turley's there were no duplicates in the series, but with half of the series a duplicate of the fourth member preceded it by intervals ranging from 1.11 secs. to 4.3 secs., the other series being for comparison with these. His results show that for intervals up to 2 secs., the preceding letter inhibits the memory of its duplicate, and for longer intervals favors the memory; and that there is a somewhat rhythmical variation in the amount of inhibition or reinforcement with increasing time.

Haines' first set of experiments was on the complication problem. A series of letters or figures mounted at regular intervals on a rotating disc and appearing before an eye tube was combined with the click of a sound-hammer. Variations of rate and length of series brought out

no new results. As an incidental variation a flash of light was combined with a series of clicks.

Next, to show that the time-error is not due to difficulty in attending to two processes at the same time, Haines carried on lengthy tachistoscopic experiments on the formation of from two to six judgments of recognition or comparison based on a group of stimulations simultaneously presented. He used Münsterberg's pendulum tachistoscope, with attachments for operating touch and sound-hammers, and required the subjects in various cases to report (1) which of two lines was shown (long or short); (2) which of two positions it occupied (high or low); (3) whether there were one or two touches on the hand; (4) whether the touches were on the right or left side of the hand; (5) which of two clicks was heard (faint or loud), and (6) whether the click was on the right or left of the subject.

In a second form of the experiment the judgments were purely comparative and all visual, the subjects being required to report on two lighted rectangles exposed together, as to (1) which was the taller; (2) which was the brighter; and (3) which had the greater number of lines across it. In the experiments of both forms the falling off in accuracy of the judgments where two, three or six were required simultaneously was so slight that Haines does not think his experiments show any interference of the various processes with each other.

The time-error in the complication experiment is due, Haines concludes, to the nature of time perception, by reason of which two processes are perceived as in the same specious present if the first has not changed perceptibly before the second begins. How this would account for the second being perceived as first, as many times happens, Haines does not clearly explain.

Burnett reports the results of a long series of experiments on the judgment of relative number based on the exposure of two groups of objects successively or simultaneously but too briefly to allow counting. In most of the tests the objects used were spots on a card, and these were varied in their shape and color, and in their arrangement, number, and dispersion on the card. In some other experiments black rings were substituted for the solid spots, and in still others steel balls in box frames were used. In some cases the subjects were stimulated by sounds of gongs or bells, by touches on the forehead, or kinesthetically, while one of the two groups was exposed.

Although the exact significance of the percentages set down in the

tables is not clear, the results can be summed up by saying that there are large individual differences as regards the effects of the various conditions on the number-judgment. The values of the data obtained by Burnett's experiment are much depreciated by the fact that the subjects were called on for introspection regarding the way in which the conditions were affecting their judgments. We have therefore neither figures showing the normal effects of the conditions, nor illuminative introspection.

Yerkes and Urban made or caused to be made tests of time judgment on 274 young women and 251 young men, all college or normal school students. These subjects were required to estimate in seconds the length of an interval verbally marked off to them under the four conditions of (1) idleness, (2) listening to reading, (3) writing, and (4) estimating as accurately as possible by any method except use of a timepiece. Time intervals of 18, 36, 72, and 108 seconds were given under each of these four conditions.

The results show that the women in general overestimated considerably the number of seconds in the intervals, and that the men slightly underestimated; that the men's judgments were less variable than those of the women; and that both men and women judged the intervals as longest while carefully estimating time, the other conditions standing in order of decreasing length: idleness, listening and writing. No mention is made of the influence of pulse-rate, although the pulse was taken in each case. The inclusion of 'Age and Physiological Rhythms' in the title is merely a notice of a future article on that subject.

Baldwin's principal purpose was to discover the relative efficiency of two words spoken in immediate succession, in determining the course of the associative train of ideas. In some cases pictures or visually presented words were used, and in still other cases the effects of three or four words were investigated. In general the second word was found to be much more effective than the first, the third less effective than the second, and a fourth more effective than the third. Aside from the order, concrete terms were more effective than abstract; names of wholes more effective than names of included parts; proper nouns than common nouns; and what Baldwin calls ' specific' terms more effective than those he calls 'general.' In these two last categories however he includes simply names of objects presently more interesting to the subject and less interesting respectively.

Töll's experiment was an attempt to compare the efficiency of association by similarity with that of association by contiguity. A

series of letters, figures, or words, containing rather formal and arbitrary similarities was presented for a few seconds, and the subject reproduced it immediately afterwards. The similarities seemed more effective than the contiguities, although the significance of the tables of results is somewhat unclear.

MOTOR IMPULSES.

The Accuracy of Linear Movement: B. A. LENFEST.
The Motor Power of Complexity: C. L. VAUGHAN.

Lenfest investigated the accuracy of regularly repeated linear movements of right and left hand and foot and of the head, at rates from 20 to 200 strokes per minute, and with extents of movement from 1 to 14 cms., using a modified ergograph and computing results with the planimeter. He obtained a large mass of interesting data which it seems impossible to sum up, and established the general fact that the rate of movement at which accuracy is greatest varies with the member moved and the extent of the movement.

Vaughan measured with the chronoscope the time taken to count series of dots, of more complex figures, of identical letters, of letters composing a sentence, and of pied letters. He found that the simple figures are counted more quickly than the complex, the differences being clear and practically uniform for seven subjects. The results with the letter series are not decisive. Next, Vaughan registered kymographically the finger reactions of seven subjects to figures of various degrees of complexity, presenting the figures serially. The subjects tried to make all movements of exactly the same extent, but the results show that the reactions to the more complex figures were uniformly greater than the reactions to the simpler ones. To the account of these excellent experiments Vaughan adds some physiological speculation which is rather large and tenuous for its modest basis.

ANIMAL PSYCHOLOGY.

The closing division of the volume contains two papers by Dr. Yerkes on the reaction-times of frogs, a paper by J. Carleton Bell on the movements of crayfish under the influence of various stimulations and conditions, and a paper by John E. Rouse on the emotional reactions and associative processes of the pigeon. This division sets a high standard of presentation, to which it is much to be regretted that more of the articles in the earlier divisions do not approach. These four papers on animal psychology are doubtless of great value

to those carrying on similar lines of study, and Rouse's paper could be safely recommended as of interest to the general reader.

<div align="right">KNIGHT DUNLAP.</div>

JOHNS HOPKINS UNIVERSITY.

VISION.

A Visual Illusion of Motion during Eye Closure. HARVEY CARR. Monograph Supplement, Psychological Review, Vol. VII., No. 3.

Illusory movements occur with closure as with finger pressure. These movements have both a lateral and a third dimensional component. Their direction and extent vary with the position of the eye in the head. With some subjects there are positions of no movement (zero points). The purpose of the paper is to study their determining conditions in relation to the concomitant physiological changes. Zero points were possessed by three out of six subjects. There is but one point for each eye. The two points for each subject are the same distance below the point of fixation of the primary position, but the distance varies for subjects; this distance is an angular constant for all degrees of convergence. The points are equidistant from the median plane; this distance varies among individuals, and is a linear constant for all degrees of convergence. The point of fixation of the primary position is not always in the median plane. Where zero points are present, the image movement for any fixation position is directed away from the zero point toward the periphery of the field of regard; the length of any movement has a given relation to the distance of the fixation position from the zero point; this relation varies among individuals. With subjects having no zero points, the direction and extent of the movements vary with the fixation position, but are similar for the two eyes. In some cases the presence of the movements depends upon the degree of convergence. The occurrence, direction, and extent of the movements are functions of the position of the eye in the head, the degree of convergence, and the character of the closure. The movements refer to the entire visual field. With binocular closure each field moves relatively independently of the closure of the opposite eye. A nasalward finger pressure generally produces the same effects as does closure. The direction and extent of these movements are functions of the position of the eye in the socket and the direction and intensity of the pressure. Suction produces the same results as closure. These lateral displacements occur for subject I. during extreme peripheral rotations. The direction of the movement is toward the periphery of the field of regard, thus varying with the position of

the eye in the head.   The movements are sometimes slightly curved,
and the field may rotate about the line of sight.   The movements with
closure, pressure, and suction refer to the entire visual field, but their
direction and extent vary for different parts of the field during the
same displacement.   The visual field is enlarged in that part of the
field toward which the movement is directed.   The apparent size of
the images decreases, their form changes irregularly, and they become
less bright and much confused in surface and contour.   Third dimen-
sional components are present for most subjects in some conditions.
The presence, direction, and extent of this component vary for sub-
jects in similar conditions, according to the degree of convergence, the
position of the eye in the socket and the character of the winking;
they are also conditioned by an interpretative factor.

The visual phenomena may be conditioned by (1) normal rotations
of the eye, (2) refractive changes, or (3) rotary-displacement move-
ments of the globe.   The image movements due to closure have been
noted, but no explanation has been attempted.   The movements due
to pressure have been explained by normal eye rotations, but the rota-
tion was assumed, and not proven.   Authorities are sceptical of any
displacement or refractive changes of the eyes, but nothing definite is
known as to the changes occurring during closure or pressure.   Rotary-
displacement movements of the eye, *i. e.*, a rotation about some center
other then the normal center of rotation, are proven by several experi-
ments: Ophthalmoscopic tests prove that the lateral image move-
ments are conditioned by an appropriate shift of the retinal stimula-
tion.   The stimulation from an object affixed to the cornea is not
shifted on the retina, and hence the image movements are not a result
of refractive changes.   The eyeball must move, and the character of
the movement is determined from measurements of the corneal and ret-
inal movements.   Refractive changes are evidenced by the presence
of a slight movement of the object affixed to the cornea, movements
of the iris, distortions of the form of the pupil, and changes in the
images reflected from the lens.   Nothing definite as to their character
could be determined.

The visual phenomena due to the eye movements are the lateral
image movements due to closure, pressure, suction, and normal rota-
tions, and the sagittal rotations.   The eye is not a perfect sphere, and is
subjected to different tensions during rotation and convergence.   Suc-
tion, pressure, and closure are disturbing mechanical forces.   Hence
the extent and direction of the image movements are conditioned by
the position of the eye in the head, the degree of convergence, and the

character of the disturbing force. The visual phenomena due to re-
fractive disturbances are the changes in the size, form, and brightness
of the visual images and the unequal movements in different parts of
the visual field.

The point of fixation, negative after-images, entoptic phenomena,
and the object affixed to the eyeball, *i. e.*, the images corresponding to
a fixed place on the retina, do not move with pressure or closure, but
do move with normal and superimposed rotations. The distance and
directional location of a visual image corresponding to any point on
the retina in relation to the position of the Cyclopean eye is called the
' space reference of the retina.' This space reference is made a func-
tion of ocular innervation. Illusions will occur whenever there is any
discrepancy between the position of the eye and the space reference,
or the state of innervation, *i. e.*, whenever the space reference changes
when the eyes are still, or when the eyes move with no change of space
reference. The illusions thus embraced are those due to (1) paraly-
sis or paresis of the eye muscles, convergence, and prism distortions,
(2) lid closure, finger pressure, suction, jars on the head, autokinetic
sensations, extreme rotations. In the first class, innervation occurs
with no proportional eye rotation, and in the second, the eye is moved
by extraneous forces where innervation is not present. The direc-
tional relation of the space reference to the head is a function of a
synergic innervation (that t ling to produce a parallel movement of
the eyes) and the distance r   'on is a function of a convergent inner-
vation (that involved in di   ce adjustments, whether it be to the
lens or eye muscles). The space reference is made a function of mus-
cular innervation because (1) changes in space reference and changes
in innervation are found together in all cases, (2) the space reference
is not anatomically related to either eye, (3) it is not a function of the
afferent conscious processes of either eye, (4) of afferent physiological
processes, (5) of attention, or (6) of memory imagery; (7) there is
no evidence in favor of the existence of ' innervation feelings,' nor
(8) is there any *a priori* objection to making it a function of a purely
physiological process.

No single principle of explanation can be found applicable to all
cases of the third dimensional movements. The phenomenon is a
result of a central factor and five peripheral factors working in con-
junction. These peripheral criteria of depth are (1) decrease of bright-
ness, (2) decrease of size, (3) confusion of surface and contour, (4)
changes of convergent innervation and (5) the binocular parallax.

By controlling the space reference of the retinæ, the ocular inner-

vation furnishes a given and fixed set of conditions governing the possible relations between visual and tactual-motor space experiences. It thus makes possible a mutual definition and coördination of the one to the other. These *conditions* are empirically worked out and interpreted as *relations* through the afferent conscious processes.

THE AUTHOR.

Über Einrichtungen zur subjectiven Demonstration der verschiedenen Fälle der durch das beidäugige Sehen vermittelten Raumanschauung. M. VON ROHR. Zeitschrift f. Psych. u. Phys. der Sinnesorgane, 1907, Bd. 41, Abt. II., 408–429.

The object of this article is to describe a series of optical instruments by which the geometrical relations of the rays of light entering the eye from external objects may be changed from the normal so that various modifications of space perception may be subjectively demonstrated. These changes occur in two main ways. In the first the direction of the rays of light is modified in a like manner for the two eyes, and in the second the relative direction for the two eyes is modified. In the first place, then, without changing the relation between the two ' object eyes,' that is the eyes conceived as being in the position to which the rays of light would pass if they had not been deflected by the optical instrument, there are three possible courses of the rays of light as they pass from the object to the eye. The first is the entocentric, in which, as in normal vision, rays from objects at a finite distance from the eye converge, so that nearer surfaces subtend larger visual angles than more distant surfaces of the same size. In the second, or telecentric arrangement the eye is placed at the focus of a lens which converges the parallel rays coming from an object, so that surfaces of the same size subtend the same visual angle at whatever distance they may be. In the third or hypercentric arrangement the opposite of the condition in the entocentric arrangement is obtained by using a lens which converges rays into the eye that have diverged toward it from a finite distance, so that surfaces which are nearer subtend a larger visual angle than those which are farther away. So far the visual axes of the two eyes have been considered as parallel and the ' object eyes ' in the normal relative position, that is with the same distance between them as between the actual eyes, and with the nasal side of each toward that of the other.

Two main variations from this position may be made, the crossed or chiastoptic position as produced by the pseudoscope, and the synoptic position in which the ' object eyes ' are situated in the same place, or

one behind the other so that the visual axes correspond. An intermediate position may be produced in which the 'object eyes' are brought together but not so far as to be in the same position. With each of these positions as with the normal, or orthoptic, there are three possible courses of the light rays as they enter the eye from the object: the ento-, tele-, and hypercentric. There are therefore nine arrangements in all. Of these nine possible arrangements the first is the normal. Some of the others have been in use for various purposes. The combination of the pseudoscopic with the telecentric arrangement has been used for the binocular microscope. An instrument called an 'eikonoscope' which brings the 'object eyes' near together for the purpose of reducing the spatial characteristics due to binocular vision in viewing paintings for example, or other two-dimensional objects, was devised by Javal. The author carries this principle further to a synoptic arrangement in an instrument which he calls a pinakoscope.

The author discusses in some detail the optical instruments by which these and other arrangements may be made, some of which have been previously known and described and others of which were devised by himself. He touches only incidentally upon the psychological phenomena accompanying the use of these instruments and the main interest of the paper for the psychologist lies therefore in its systematic presentation of the ways in which the relation between the elements going to make up space perception may be modified by optical means.

FRANK N. FREEMAN.

YALE UNIVERSITY.

Ueber den Einfluss des Helligkeitskontrastes auf Farbenschwellen. ROSWELL PARKER ANGIER. Zeitschrift f. Sinnesphysiol., 1906, XLI., 343–63.

In investigations of simultaneous brightness or color contrast four sets of conditions are possible: (1) a colorless field on a colored background; (2) a colored field on a colored background (color contrast); (3) colorless field on colorless background (simple brightness contrast); (4) colored field on colorless background. This last is necessary for discovering any relations eventually existing between brightness contrast and color perception, which is the object of Angier's work.

The conditions were varied experimentally in threefold manner; (1) change in brightness of the colored field alone by means of white light; (2) change in brightness of background alone; (3) simultane-

ous and equal change in the brightness of the background and colored field. The screen received its illumination from three sources: (1) a white light, falling directly upon it, illumined the background; (2) another white light, situated behind the screen, had its rays deflected so as to pass through an opening in the screen which was to constitute the colored field; (3) a third light, also behind the screen, whose rays passed through colored gelatine discs and then through the same opening as the second white light. The colors for the field were used in pairs [red-green and yellow-blue], one pair occupying the field at a time. The completed series, however, was worked through only with the red-green pair. Each pair was matched in brightness by the periphery of the light-adapted eye. The observer fixated the colored field and the experimenter gradually increased its intensity; then at the moment a color appeared at the threshold, the observer indicated the color and the half of the field which it occupied.

The question may be asked whether the match really remained perfect with the changing intensity of the light passing through the discs of pigmented gelatine. If not, the difference in brightness between the two halves might possibly affect by brightness contrast the threshold value of the color to be perceived and thus vitiate the results. Added to this is the possibility of the enhancement of the redness of the red by its complementary green, and vice versa. Another question which arises is this: Is not the intensity of the colored field actually higher than that of the background, when *e. g.*, in Table V, we have the value of the inner and outer white lights given as equal? For as a matter of fact the inner or colored field has added to the white value of the outer white light the white value of the light passing through the colored disc, so that the actual intensity of the inner field would be greater than that of the background. Hence a brightness contrast would result, yet the assumption is that there is no such contrast. The error arising from these conditions may, however, be very slight and may not materially affect the conclusions, especially since it was not attempted to cast these into a mathematical formula. Nowhere in the paper is there record made of false or uncertain judgments.

Angier thus summarizes his results: When a colored field decreases in brightness as a result of a contrast with a more intensely illumined background, the threshold value for the perception of color rises, and the rise of this threshold value is on the whole parallel with the increase of the brightness of the background above that of the colored field. A decrease in the brightness of the background below

that of the colored field appeared to have no definite influence upon the threshold. If on the other hand the intensity of the inner field alone or of both fields be simultaneously changed, we find a decrease or a rise of threshold values accompanying a decrease or a rise, respectively, in intensity. Hence, if the brightness of the colored field decreases as a result of contrast, the threshold value rises, but if the intensity of the colored field is itself decreased, the threshold value decreases. *I. e.*, if the brightness of a colored field or its background be increased by the addition of white light, the objective threshold value will be found to rise in both cases, although, in the first case, the brightness of the colored field subjectively *increases* and the degree of saturation *decreases*, while in the second case the brightness *decreases* and the degree of saturation *increases*.

<div align="left">UNIVERSITY OF CHICAGO.</div> <div align="right">CARL RAHN.</div>

Ueber den Einfluss des Sättigungsgrades auf die Schwellenwerte der Farben. F. P. BOSWELL. Ztsch. für Sinnesphysiol., 1907, XLI., 364–366.

Colored lights were projected on a disc of milk-glass by means of an incandescent lamp. The description of the method is rather meagre, there is no statement concerning the medium through which the colored lights were projected, nor concerning the size of the disc upon which they were thrown. One hundred determinations were made of the thresholds for each of the three colors, 50 tests being made with the colored lights alone, and 50 with the colored lights plus an admixture of a subliminal amount of white light. The complete series was carried out on two subjects whose eyes were thoroughly dark adapted.

Results. — The threshold was lowered in every case by the addition of white light, the average amount of decrease being, for the first subject, *green* 30 per cent., *red* 19 per cent., *violet* 34 per cent.; and for the second subject green 45 per cent., red 26 per cent., and violet 18 per cent. The results seem to justify the conclusion that, at least in the case of the two subjects tested, the threshold of a color is lowered by the admixture of white light. It is to be regretted that the descriptions of the apparatus and general method of procedure is not more complete and that the determinations were not made on a larger number of subjects.

The explanation offered by Dr. Boswell for his results is that the white light increases the general sensitivity of the visual organs in such a way that they are more readily affected by a color stimulus.

<div align="left">BRYN MAWR COLLEGE.</div> <div align="right">GRACE M. FERNALD.</div>

FATIGUE AND PRACTICE.

The Relative Effects of Fatigue and Practice Produced by Different Kinds of Mental Work. J. H. WIMMS. Brit. Jour. of Psychol., 1907, II., 153–195.

This paper is an extended abstract of a thesis investigation; its first aim is found in the writer's interest in questions relating to fatigue and practice in school work; the second is an attempt to carry the work of Oehrn a step farther by using mental work of greater homogeneity than Oehrn's. The author assumes this last condition satisfied by addition and multiplication tests based on Kraepelin's Rechenhefte. To round out Oehrn's method, the writer follows Hylan and Lindley in the arrangement of the experiment.

In the additions, each pair of digits was added and only the unit digit of the sum written, to lessen muscular fatigue. In the multiplication tests there were three series, consisting of the multiplication of two, three, and four digits respectively. In both addition and multiplication the plan followed was a pauseless series, twenty minutes in length, a second series of two ten-minute periods separated by a rest period of ten minutes, and a third series with a rest period of twenty minutes intervening; these were given twice a week, making a total of thirty-six tests.

Twelve boys from fourteen to sixteen years of age acted as subjects. They were selected with regard to the regularity of their home life. The multiplication of two and four digits constituted a second research, with a different group of boys and in the following school year. The maximum of attention and interest was obtained by awarding prizes to those who worked ' most consistently throughout.' The author, as their regular instructor in mathematics, gave the tests; thus, ' the results . . . give a very good indication of their regular working capacity.' No mention is made of the work of Ebbinghaus and Thorndike on this point.

The discussions and conclusions are grouped under the headings, ' The More Favorable Pause and the Effects of Incitation,' ' Absolute Amount of Work Done,' ' Improvability,' ' Retentivity of Practice,' and ' Fatiguability.' Both researches give almost ' identical results.' The shorter rest pause proves more favorable with the harder tasks than with the easier. As a rule those boys whose absolute amount of work is greatest in the easier task also stand highest in the more difficult; the coefficient of correlation is .58; probable error .12. Improvability is greater with the harder task, and does not correlate with the absolute amount of work done; in the additions R is .37; in the

multiplications .22. Retentivity of practice (not retentiveness) is probably greater with the harder work, R equals .33. At the outset, fatiguability is greater with the harder task, but this relation reverses, and the coefficient for the whole relation of additions with multiplications is .2. Similarity of degree in improvability and retentivity of practice is as apt to occur as either type of dissimilarity; a result contrary to the conclusions of Kraepelin and his school. High improvability with low fatiguability or the reverse is more common than a similarity in tendency, a point in agreement with Kraepelin's work (p. 190 states this, while p. 178 f. shows an equality). An inverse relationship is apparent throughout between retentivity of practice and fatiguability. Improvability in the multiplication of two digits compared with that in the multiplication of four digits yields R equal to — 0.13.

To calculate results, the author uses principally the methods devised by Hylan and Lindley. In determining the R, Spearman's 'foot-rule' method is tested, and a comparative table shows the 'foot-rule' calculation as accurate as, and far easier of application than, the usual r method. To determine fatiguability, the writer suggests that after the more favorable pause is found, fatiguability may be easily calculated by comparing the amount of work done in the second period of the experiment containing this more favorable pause. The reviewer can only suggest here, that the danger of over-simplification is as great in the one case as is the probability of error in the other; 'Incitation' and Antrieb are varying factors, to mention no others, that influence results in the necessarily serial order of this type of experiment.

The introspective notes of the pupils, written in answer to a prepared set of questions, indicate in over half the cases a 'sense of increasing fatigue'; in some cases muscle fatigue, one reports a 'mental fatigue,' weariness, a desire to sleep, worn-out feelings, muddled conditions, etc. are reported. Liability to distraction is reported for the easier tasks, but no statement on this point is possible for the multiplications, on account of conflicting testimony. Concentration of attention is greater for the harder tasks, the other could be done 'mechanically.' No introspective report is made of errors, nor does the writer mention them in discussing the numerical results or in ranking his subjects.

To the reviewer, the paper shows possibilities in applying Oehrn's simple addition method to school work; though strangely enough teachers had so far failed to test it. This is the first test of the method outside the Munich laboratory, and ought to have been checked by

adult work at the same time; as it is, however, we note conclusions somewhat at variance with those results. Work done in this laboratory during the past year confirms some of these conclusions and points to the discovery of other variants. The work reported is not psychologically error proof, due principally to the class of subjects used.

<div align="right">C. S. Yoakum.</div>

University of Chicago.

REACTION AND THOUGHT.

Ueber die Willenstätigheit und das Denken. Narziss Ach. Göttingen, Vandenhoeck & Ruprecht, 1905. Pp. 294.

In the author's view, experimental investigation of the will has made little progress because of the lack of a suitable method. In reaction experiments the chief stress has been laid on time values and although several investigators, especially Martius, Dwelshauvers, Münsterberg and Wundt, have shown that a serious regard must be paid to the psychological factors involved, no one has, as yet, made a thoroughgoing analysis of them.

In this work the attempt is made to use the method of 'systematic experimental self-observation.' This consists in occasioning experimentally in the subject certain mental experiences that are then at once subjected by him to a careful description and analysis, aided by appropriate questioning from the conductor of the experiment. Each experiment has three temporal divisions: (1) the preparatory period (Vorperiode) — the time elapsing between a signal that gives notice that the stimulus to be reacted to is about to occur, and the coming of the stimulus itself; (2) the main period (Hauptperiode) — the time between the application of the stimulus and the reaction to it, this time embracing the mental processes under introspective investigation; (3) the after-period (Nachperiode), which immediately follows the reaction. During this period the psychic processes of the 'Hauptperiode' are to be analyzed and described. The subject knows at the beginning that he is to make this analysis, but during the main period he has simply to perform his reaction as quickly as possible, and not to analyze his mental state. In case analysis is, during the main period, detected by its interfering with the reaction, the experiment is thrown out. With practice such cases become rarer. The after-period is usually one of several minutes.

The reaction tests actually used in the experiments that Ach reports were the ordinary ones, the only claim to originality being in the thorough carrying out of the method of systematic self-observation.

Between sense-stimulus and reaction no act of will was found to be necessary; for, since an initial purpose to make the movement was present, the kinæsthetic idea is ready to go over into movement so soon as the associated stimulus occurs; the act of will takes place, therefore, not after the appearance of the stimulus, but before the experiment begins (p. 119). The essential distinction between muscular and sensorial reaction does not depend, according to Ach, on the concentration of attention on the stimulus on the one hand, or the movement on the other, but on the subject's intense purpose to react either as quickly as possible or only when he has fully perceived the stimulus (p. 122). The term 'choice-reaction' is, furthermore, a misnomer, since no choice takes place in the main period; there occurs simply the interposition of an intermediate member between the perception of the stimulus and the reaction, namely, the presence in consciousness of the acoustic-kinæsthetic idea of the movement of the appropriate finger, or, if different stimuli are to be reacted to, the movements of different fingers. The movement may immediately follow the intermediate member or be preceded by 'intentional movement sensations' by which the finger is put in a state of preparedness for movement. These disappear with practice. 'Intentional movement sensations' are peculiar sensations in the muscle-organs that point out in consciousness the direction in which a movement shall occur. There is, however, no necessity of the movement's occurring in the organs whence the sensations arise, or, indeed, of its taking place at all (p. 151).

The effect of an idea of the goal is discussed by the author at some length. The effects proceeding from such an idea and causing a determination in accordance with the meaning of the 'goal,' are called the 'determinating tendencies' (determinierende Tendenzen). The effect of the stimulus is different, according to the 'tendencies,' although, as in post-hypnotic suggestion, one may be no longer conscious of their determining influence.

Although the book is well worth reading, the results obtained and the views given might, perhaps, have been somewhat condensed in the telling of them.

C. L. VAUGHAN

PRINCETON UNIVERSITY.

DIZZINESS.

Ueber Nachempfindungen im Gebiete des kinaesthetischen und statischen Sinnes. Ein Beitrag zur Lehre vom Bewegungs-schwindel (Drehschwindel). HANS ABELS. Zeitsch. f. Psychol., 1906, XLIII., 268–289, 374–422.

The impulse to the present study was found in observations and studies upon seasickness which the author made as a physician of the Austrian Lloyd. Seasickness has been looked upon as a form of movement dizziness and shows the same characteristics. The first facts to present themselves with respect to seasickness are the striking individual differences and the influence of habituation. These are given careful consideration by the author as points of importance in the whole subject of movement sensations with their after-sensations and of turning sensations after turning movements. 'Nur dieses Gefühl des Verwirrtseins bezeichnet der Sprachgebrauch als Schwindel.' The author holds that seasickness and movement dizziness are essen-tially of the same character and so reviews all the work that has been done upon movement sensations, after-sensations of movement, and illu-sions of movement to find an interpretation for dizziness in general. He criticises Mach and Breuer for holding that turning sensations of short duration can have after-sensations of long duration and repudiates the idea that dizziness can be due to a functional peculiarity of the vestibular apparatus or to a mechanical imperfection or incomplete-ness of the statical end organ. He reviews Jensen's experiments upon galvanic dizziness and shows that this is due alone to the long stimu-lation of the skull. His main contention is that only long durations of stimulus can have long after effects and correlates this with the after-dizziness from long rotations. This principle, he claims, is valid in the general physiology of the senses and takes Mach to task for employing special principles in his explanation of results obtained in the study of progressive acceleration. Progressive movements as well as continuous rotations produce exhaustion of the movement sensation just as continuous stimulation in other sensory fields. The up-push felt in the arm which has held a pail of water that has been allowed to flow out rapidly, reversed motion perceived in trains whose speeds are rapidly decreasing or in elevators coming to a sudden stop, and the sensations of heaviness after allowing the water to flow quickly from a bathtub, are explained by the fact that all motion is the result of opposing muscular tendencies and that under the unusual circum-stances one side of the mechanism is fatigued and perhaps the other side is rendered hypersensitive by the long absence of the usual stimu-

lation. To progressive movement habituation has taken place in daily experiences, but not so for rotations. Hence the prominence of after-sensations in the latter as compared with the other. Habituations to rotation movements are possible and are found in experienced dancers and skilled skaters. The after-sensation from rotation comes only with long stimulation, — this he bases upon his own experiments with rotating human subjects and doves,— and cannot be due to the sudden or momentary shifting of the cupula as Breuer supposes or to the waving of the auditory hairs or ossicles with Brown. In this study of rotations he finds two sensation elements, the swinging sensations that give speed and mediate position of rotation axis, etc., and the sensation corresponding to angle acceleration which registers meaning, direction and change of rate. The latter is always of short duration. These sensations are usually combined in daily life, which furnishes only short turning movements, but under experimental conditions they may be separated entirely from one another. Lasting rotations are entirely abnormal and dissociate these elements by calling them out in different measures so that to the higher centers a complex of sensation elements are mediated that stand in unaccustomed and often opposing relations. After-dizziness never attains to the clearness of a real sensation as it should on Breuer's hypothesis. These two sensation elements have after-sensations, and it is to the unusual combinations of these in the higher centers that dizziness is due. The author rests his argument upon a very closely critical examination of the work of others and makes only a subordinate use of his own experimental studies. He scarcely satisfies the hope that he raises at the beginning by mentioning seasickness. The reader is led to expect some light upon the question of the disturbance of the vomiting center by the arousal of dizziness sensations. However, the work has been carefully done and one cannot help but be impressed with the strength of the argument, especially with the negative conclusion towards the hypotheses of Mach and Breuer.

<div align="right">T. L. BOLTON.</div>

UNIVERSITY OF NEBRASKA.

BODY AND MIND.

Leib und Seele : Darstellung und Kritik der neueren Theorien des Verhältnisses zwischen psychischem und physischem Dasein. R. EISLER. Leipzig, Barth, 1906. Pp. 215.

The author takes up Dualism, Materialism, the Identity theory, Interactionism and Parallelism, giving an exposition and criticism of

each in turn, and concluding with a brief discussion of the problem of immortality upon which he thinks his own spiritualistic phenomenalism throws new light.

Like most discussions of the mind-matter problem the validity of the argument turns on certain underlying assumptions :

1. The assumption of the priority of self-consciousness (cf. p. 93 f.). This leads the author to a spiritualistic monism or panpsychist parallelism. Reality is ultimately psychical in its nature. Physical objects are phenomenal manifestations of psychical subjects as they appear to one another.

The same presupposition crops up in the insistence on the more real and more immediate character of consciousness (cf. p. 47 f.). This results from confusing the first and the third person's points of view.

2. Closely connected with this is the assumption of the existence of unconscious mental states which parallelism finds so helpful in eluding its difficulties and so useful in covering up its obscurities (cf. p. 100 f.). Not all the psychical is in consciousness, he says. The psychical correlates of certain physiological processes are unknown to us. He admits that there is no mental process (not even the so-called higher intellectual activities) which has not its physical basis or counterpart, and he sees that this conception does not necessarily imply materialism, but he does not see that by this admission he would have to reconsider his metaphysical idealism.

3. The assumption of the disparateness and incomparability of mind and matter (cf. p. 45 and Cap. IV. *passim*). The psychical differs from the physical in that it consists of qualitative whereas the physical consists of quantitative relations. The dictum recurs here (which so few writers have had the courage to challenge) that the psychical and the physical are characterized by different properties or qualities. Physical properties like extent, solidity, color, heat, movement cannot be predicated of the psychical.

The sensation ' red ' is not itself red, the sensations of spatial extent are not themselves extended. In short, " The determinations and changes of the contents of consciousness or experience are not identical with the determinations and changes of experiences as states or acts of the subject " (pp. 15–16).

But a dualism of content and process is not much improvement on an ontological dualism, if it is taken statically.

4. The assumption of the parallelism of the psychical and the physical. The author seeks to reconcile interactionism and parallelism

on epistemological grounds. The physical world is phenomenal only — a manifestation of what in reality is psychical in character. The causal interaction between soul and body is therefore an interaction between different levels of the psychical, while the parallelism of the psychical and the physical is simply the duality of the reality and its phenomenal appearance. The parallelism of consciousness and brain states is the result of an interpsychical causal relation (cf. p. 147 f.).

H. HEATH BAWDEN.

UNIVERSITY OF CINCINNATI.

BOOKS RECEIVED FROM SEPTEMBER 5 TO OCTOBER 5.

National Educational Association. — *Fiftieth Anniversary Volume, 1857–1906.* Winona (Minn.), Publ. by the Association, 1907. Pp. viii + 949.

Index by Authors, Titles, and Subjects to the Publications of the National Educational Association for its First Fifty Years, 1857 to 1906. Winona (Minn.), Publ. by the Secretary, 1907. Pp. 211.

The Ego and Empirical Psychology. W. B. PILLSBURY. Reprint from Philosophical Review, Vol. XVI, No. 4; July, 1907. Pp. 24.

Contemporary Criticism of Friedrich Nietzsche. F. S. BAKER. Reprint from Journal of Philos., Psychol. and Sci. Methods, Vol. IV, No. 15; July, 1907. Pp. 16.

Rudolf Eucken's Philosophy of Life. W. R. BOYCE GIBSON. New York, Macmillan Co., 1907. Pp. 182. $1.40.

Outlines of Psychology. WILHELM WUNDT. Translated by C. H. JUDD. Leipzig, Engelmann, 1907; New York, G. E. Stechert & Co. Pp. xvi + 392. Mk. 8.

Twenty-fifth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution. Washington, Government Printing Office, 1907. Pp. xxix + 296, pl. cxxix.

NOTES AND NEWS.

The Second Annual Conference of Teachers of Psychology in Normal Schools and Colleges was held May 10–11 in Milwaukee. Milwaukee-Downer College and the Milwaukee Normal School were the hosts, the sessions of the conference being divided between the two.

This conference was organized a year ago. The constituency is at present drawn from Michigan, Wisconsin and Illinois.

The first session of the meeting was devoted to a discussion of the place of genetic and functional psychology in the curriculum. Papers were read by Professors I. E. Miller of Milwaukee, and A. W. Trettien of Carroll College and Dr. D. P. McMillan of the Child Study Department of the Chicago public schools. At the next session papers were presented by Professors W. C. Gore of the University of Chicago, J. H. Farley of Lawrence University and W. D. Scott of Northwestern University, discussing the peculiar difficulties which beset the presentation of elementary psychology and suggesting various specific methods for enriching and vitalizing the content of such courses. In the evening Professor Jastrow of the University of Wisconsin delivered a public address entitled ' Psychology : clinical and academic.' At the final session the following papers were presented : ' A physiological interpretation of feeling,' by Professor Harvey, of the Michigan Normal College ; ' Suggestions toward a real educational psychology,' by Professor Irving King of the University of Michigan ; ' Æsthetic factors in education,' by Professor J. T. McManis of the Western Michigan Normal School ; ' The value of a biological point of view for educational psychology,' by Professor J. R. Angell of the University of Chicago. It was voted to hold the next regular meeting at Chicago in 1909.

In connection with the appointment of Dr. C. Judson Herrick to a chair of anatomy in the University of Chicago, we note the removal of the editorial offices of the *Journal of Comparative Neurology and Psychology* from Granville, Ohio. The new address is Hull Laboratory of Anatomy, University of Chicago.

An American editorial board has been organized for the *Hibbert Journal* to co-operate with the present British board. We note the names of Professor Josiah Royce, of Harvard University, Professor G. H. Howison, of the University of California, and Professor A. O. Lovejoy, of Washington University.

Professor H. Heath Bawden, of Vassar College, has been appointed to a chair of philosophy in the University of Cincinnati.

Mr. Herbert H. Woodrow, last year demonstrator in the Psychological Laboratory at Princeton, has been appointed lecturer in psychology at Barnard College, Columbia University.

Dr. Clement L. Vaughan, who has been working for a year in Professor Nagel's laboratory at Berlin, has been appointed demonstrator in the psychological laboratory at Princeton University.

DR. DANIEL E. STARCH, formerly instructor in psychology at the University of Iowa, is appointed instructor in experimental psychology at Wellesley College. Dr. Starch is also carrying on work in the Harvard Psychological Laboratory.

PROFESSOR HOWARD C. WARREN, of Princeton University, has returned from Europe, where he has been spending the summer.

THE following items are gathered from the press:

DR. HENRY W. STUART, of Lake Forest University, has been appointed assistant professor of philosophy at Stanford University.

DR. ERNEST ALBEE, has been advanced to a professorship of philosophy at Cornell University.

DR. J. B. PORTER has been promoted to an assistant professorship in psychology at Clark College.

DR. GEORGE SANTAYANA, assistant professor of philosophy at Harvard University, has been appointed professor of philosophy.

DR. PERCY L. HUGHES has been appointed assistant professor of philosophy and psychology at Lehigh University.

MR. A. B. SUTHERLAND has been appointed assistant in philosophy at the University of Wisconsin.

MR. GREGORY D. WALCOTT, Ph.D. (Columbia), of Blackburn College, has been elected professor of philosophy in Hamline University.

DR. F. LYMAN WELLS, lecturer in psychology in Columbia University, has been appointed pathological psychologist in the McLean Hospital, at Waverley, Mass.

EDWIN G. DEXTER, Ph.D., professor of education in the University of Illinois, has left the university to take up his duties as commissioner of education in Porto Rico.

PROFESSOR W. J. NEWLIN, associate professor of mathematics and psychology at Amherst College, has been appointed associate professor of philosophy. He will continue the work which he has carried on since the death of Professor Garman.

MR. ROWLAND HAYNES, associate at the University of Chicago during the past year, has been appointed instructor in psychology at the University of Minnesota. The psychological laboratory there is to be reopened under the supervision of Professor Miner.

DR. CHARLES HUGHES JOHNSTON, substitute during the past year for Professor H. H. Horne at Dartmouth College, has been appointed assistant professor of the philosophy of education at the University of Michigan.

DR. JOHN B. WATSON, of the department of psychology at

Chicago University, has been spending some time at the Station for Marine Biology of the Carnegie Institution at Dry Tortugas, where he has been studying the habits of sea-gulls.

ON THE occasion of the celebration of the seventy-fifth anniversary of the foundation of Lafayette College, the degree of doctor of letters was conferred on Professor Hugo Münsterberg, of Harvard University, and the degree of doctor of laws on Professor J. McKeen Cattell, of Columbia University.

PROFESSOR KUNO FISCHER, professor of philosophy at Heidelberg, died on July 5, at the age of eighty-three years.

THE death of Dr. Charles Féré, physician at the Bicêtre, Paris, and well known for his researches in neurology and psychiatry, was also reported during the summer.

DR. N. ACH, docent for psychology at Marburg University, has been called to the chair of philosophy there.

DR. CHARLES SPEARMAN has been appointed reader in experimental psychology in University College, London.

PROFESSOR CARL STUMPF has been elected rector of the University of Berlin.

PROFESSOR WILLIAM JAMES has been elected a corresponding member of the British Academy.

THE General Board of Studies of Cambridge University recommends, in place of the present lectureship in physiological and experimental psychology, the establishment of two lectureships, one in the physiology of the senses and the other in experimental psychology.

Corrigenda. — In the article on ' The Physical Basis of Conduct,' by E. G. Spaulding, which appeared in the September BULLETIN :

p. 274, l. 14, *for* conservative *read* conservation ;

p. 277, l. 26, *for* correct one *read* the correct one ;

p. 283, note 2, l. 4, *for* Now *read* Here.